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National Plant Germplasm  
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Seventeenth Meeting Report  
July 17, 2001

Sunflower Crop Germplasm  
Committee



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The Sunflower Crop Germplasm Committee (CGC) met for the seventeenth time on July 17, 2001, at Ames, IA. Committee members present were: G. J. Seiler (Chair), L. Charlet, T. Gulya, J. Miller, D. Baltensperger (Vice-chair), K. Grady, M. Bohning (Facilitator's Office), and M. Brothers (Ex-Officio, Curator). Observers present were: B. Vick, M. Olson, R. Oliveira, C. Block, R. MacArthur, and T. Gross.

## AGENDA

### 1. Nomination and Election of New Committee Members

Nominations were accepted from the Committee members to fill several positions expiring in 2000 and 2001. Dr. Gerald J. Seiler was re-elected Chair for the term 2002-2005. Members elected for the 2001-2004 term were: Dr. Larry Charlet, USDA-ARS, Fargo, ND, Dr. Rob Aiken, Kansas State University, Agricultural Experiment Station, Colby, KS and Dr. Glenn Cole, Pioneer Hi-Bred International, as Industry Representative, Woodland, CA. Members elected for the 2002-2005 term were: Dr. Tom Gulya, USDA-ARS, Fargo, ND, Dr. Kathy Grady, South Dakota State University, Agricultural Experiment Station, Brookings, SD and Dr. Florin Stoenescu, Interstate Payco Seed Company, as Industry Representative, West Fargo, ND. The Committee would like to thank those members who have served terms and those who have agreed to serve additional terms as members of the Sunflower CGC.

### 2. Sunflower Evaluation

**Disease Evaluation:** Dr. Tom Gulya updated the Committee on the progress of evaluation for diseases. Downy mildew (DM) screening of 332 cultivated accessions not previously evaluated for race (phenotype) "773" resistance has been completed. Six accessions had 25 to 40 % non-infected seedlings to DM (**Appendix 1**). Since there has been a change in the nomenclature of DM races, the committee recommended that the evaluation data already in GRIN be updated to reflect the new nomenclature. Dr. Charlie Block, USDA-ARS, Ames, IA continued the screening of wild and cultivated accessions for *Alternaria* resistance. He has also continued his screening evaluation of wild *H. annuus* populations to *Alternaria helianthi*, *Septoria helianthi*, and powdery mildew.

Dr. David Baltensperger commented about the persistent head rot disease, *Rhizopus* in the High Plains. This disease is predisposed by physical damage to the heads, of which hail is the suspected cause. The Committee has discussed this before, but have not found a cooperating pathologist willing to undertake this research at a location of natural infection. The Committee will continue to seek a cooperator for this research.

**Insect Evaluation:** Dr. Dick Wilson (retired), USDA-ARS, Ames, IA screened 50 core collection accessions for resistance to sunflower moth, *Homoeosoma electellum*. Dr. Larry Charlet, USDA-ARS, Fargo has contributed data for stem weevil (*Cylindrocopturus adspersus*) evaluation.

The Committee strongly **Recommended** the continuation of sunflower insect evaluation at Ames with the recent retirement of Dr. Dick Wilson. The committee would like to acknowledge his cooperation evaluating germplasm for the sunflower moth resistance. Since his position will not



be refilled, the Committee encourages the Coordinator to use available expertise to continue the evaluation. Dr. Larry Charlet has agreed to serve as a resource for personal at the PI stations doing sunflower evaluations.

**Oil Quality Evaluation:** Dr. Brady Vick, USDA-ARS, Fargo, ND has screened several cultivated accessions for fatty acid composition in search of low saturated fatty acids. He contributed additional data on the long-chain saturated fatty acid, behenic acid.

The Committee would like to thank all the cooperators who have provided evaluation data for the many descriptors. Ms. Mary Brothers, Curator, has coordinated the transfer of the data into GRIN. The GRIN database for sunflower has one of the highest frequencies of descriptors per accession of any crop in the GRIN system.

### 3. Curator's Report with Status of the Sunflower Collection

Ms. Mary Brothers, Geneticist/Sunflower Curator, presented a report on the sunflower collection (**Appendix 2**). Since the last CGC meeting in 1999, 76 *Helianthus* accessions (31 wild and 45 cultivated) were received and logged into GRIN. One hundred-thirty-two wild accessions were under cages for regeneration in 2000. Ninety-six cultivated accessions were planted in the field for hand pollination. Two hundred-thirty-two accessions were sent to the National Seed Storage Laboratory (NSSL), Fort Collins, Colorado, for backup. At present 72% of the sunflower collection is duplicated at the NSSL.

Ms. Brothers reported that in 2000 there were 47 requests (12 foreign and 35 domestic) for *Helianthus* accessions, representing 1701 packets of 1328 accessions or 35% of the collection. This was a slight decrease compared to last year. Descriptive definitions and GRIN data were reviewed and corrected. In earlier GRIN versions, a series of *Helianthus* descriptors were used to capture multiple values for a specific traits (for example SEEDCOLOR1, SEEDCOLOR2, and SEEDCOLOR3). These descriptors were merged into a single descriptor and the primary, secondary, and tertiary values are now indicated in the frequency field. These changes make querying the database user-friendlier, especially for the public database users.

The Committee discussed the general regenerations plans for the collection. At present, the majority of accessions regenerated during a year have been wild *H. annuus*, with a few other annual species. About 70% of the 1000 wild *H. annuus* accessions are available for distribution. Upon closer examination, several the annual species have availability rates as high *H. annuus*. There is a group of very difficult to regenerate annual species that have special requirements. The perennial species also require special care for regeneration. The Committee did not come to a consensus concerning the regeneration priorities. They felt that it would be helpful for the Committee to review the curators regeneration plans in the future.

For a number of years the NPGS has been looking for an alternate regeneration location for difficult to regenerate accessions. A site has been established at Parlier, California. The committee strongly **RECOMMENDED** that the curator work with the Parlier site coordinator to explore the possibilities for using this site for the difficult to regenerate sunflower accessions. The Committee strongly supports the activities of the Parlier site and hopes that cooperation with this location will help alleviate the backlog of sunflower accessions waiting to be regenerated



because of specific requirements not being able to be met at the present regeneration site at Ames.

**FUTURE PLANS:** Ames numbered cultivated accessions will be reviewed for assignment of permanent PI numbers. Wild *Helianthus* accessions will continue to be assigned PIs as they become available for distribution. Management of the perennial *Helianthus* nursery is ongoing. Additional species have been planted into the perennial nursery. Each year several plots are caged and the plots are destroyed after a successful seed increase. Isozyme data form the core subset assessing genetic diversity needs to be verified and analyzed. Future application of molecular technology to the sunflower collection needs to be identified and prioritized.

#### **4. Sunflower Core Subset**

Ms. Mary Brothers, the sunflower curator, has initiated a study to characterize the isozyme profiles of the 112 accessions of cultivated sunflower in the core subset, plus a randomly chosen array of 112 accessions. A few rare alleles were identified. The isozyme data will be used to further test the validity of the core subset and to elucidate further inter-and intra-cluster relationships. The data needs to be verified and analyzed.

#### **5. Problematic PI's and related information**

Ms. Mary Brothers distributed a list of 175 accessions with problematic issues related to them (Appendix XX). The basic problem is that they were distributed from the original source to other countries with the same name so they are all from the same original source, but have been maintained in various countries in various ways. It is uncertain if the accessions are still genetically representative of the original populations. Dr. Jerry Miller agreed to investigate these accessions further to see what can be done to eliminate duplicate accessions, if any. The Committee recommended that the information be achieved in the meantime.

#### **6. Status of *Helianthus* germplasm— Needs and Recommendations**

The Committee discussed the status of the sunflower germplasm collection. A copy of the sunflower needs and recommendations report is included in **Appendix 3**. The Committee expressed interest in coordinating research activities to obtain maximum results.

#### **7. Status of the GRIN System**

Mark Bohning briefed the Committee about the GRIN system (**Appendix 4**). There are currently 24 germplasm maintenance sites using GRIN for their data management activities. Direct access to the GRIN system is available to anyone through the World Wide Web (<http://www.ars-grin.gov>). NPGS web pages receive about 600 visits and generate 4,500 database queries each day. At this time approximately 450,000 accessions representing 10,100 species are cataloged in



the database. Development of a new graphical interface for the plant database is progressing. As old software is no longer supported, new software is evaluated. Oracle software is being evaluated and used in the new database development. An upgraded PC version of GRIN that runs on any IBM compatible PC is available for distribution upon request for sunflower and other crops. The release provides two major improvements, including a Windows-like environment and also allows users to add additional data with ability to update the data. The main focus of the upgrade was to provide a tool for underdeveloped countries which do not have the resources to develop their own genetic resources management system. This is an example of benefit sharing which has become an issue in international germplasm exchanges.

## **8. CGC Chairs Meeting**

The eighth biennial CGC Chairs meeting was held July 19-20, 2000 at Beltsville, MD. Numerous topics relating to the NPGS and genetic resources management were discussed. These included status reports from the NPGS active and base collections, ARS National Program 301 (Plant, Microbial, and Insect genetic Resources, Genomics, and Genetic Improvement), roles and expectations of CGC, international issues impacting access to and exchange of germplasm, intellectual property rights issues relative to USDA Genetic Resources collections, status of the American Seed trade Associations initiative to secure additional funding for the NPGS, funding for plant exploration and germplasm evaluation, and GRIN--status and future plans, and data issues. Summary reports concerning each crop germplasm collection were distributed. The status of the sunflower collection is covered in a series of reports (**Appendix 5**). The reports covered the taxonomy, number of accessions, number of accessions by country, backup status at NSSL, core subset, and a summary of evaluation data.

## **9. Sunflower Exploration**

Dr. Gerald Seiler reported on the exploration to collect *H. anomalus* and *H. deserticola* from Utah, Arizona, and Nevada (**Appendix 6**). Only two accessions of *H. anomalus* and one of *H. deserticola* were collected over a 2550 mile route. It had been an extremely dry year in most areas explored, with most locations having no evidence of these wild sunflowers being present during the season. Over 25 locations were revisited where seed had been collected before. Both species grow in very specialized habitats which are very fragile, i.e. shifting sand dunes and sandy desert shrub habitat. The three populations collected had very good seed set and are available for distribution. Accessions of these species had not been available for distribution for almost 20 years.

The exploration also attempted to evaluate an assessment of the distribution of germplasm diversity in *Helianthus* based on sets of eco-geographic characters developed by Dr. Robert Webster, Beltsville, MD. It was the intent during the exploration to evaluate the distributional maps generated by this project for the two taxa, but it was impossible to test due to the lack of populations available during the very dry year. This will have to be evaluated during future explorations.



Dr. Tom Gulya in conjunction with Dr. Gary Kong, Toowoomba, Queensland, Australia collected *Helianthus* in California in 2000 for new sources of resistance to Australian rust races. They have gathered some interesting information and contacts about *H. bolanderi/exilis* (**Appendix 7**) In 2001, Dr. Gulya made limited collections of a rather limited distribution species, *H. niveus* ssp. *tephrodes* from the Yuma dunes and Algodones dunes of California. He has made some valuable contacts for locating this relatively restricted species for future collections (**Appendix 8**).

#### **10. Changes to By-Laws**

The by-laws were updated in terms of who the Committee reports to since the old by-laws made reference to Committees that no longer exist. The Committee also recommend that the terms of members be increased from three years to four years ( **Appendix 9**).

#### **11. New Business**

Mark Bohning encouraged the Committee to update the CGC's priority needs and recommendations (see **Appendix 3**).

#### **12. Location and Date of Next Meeting**

The CGC Committee is scheduled to hold their next meeting in the winter/summer of 2003 in conjunction with the winter/summer meeting of the National Sunflower Association, at Fargo, ND or Detroit Lakes, MN, or possibly at the Panhandle Research and Extension center, Scottsbluff, NE.



### CGC Meeting Ames IA July 17, 2001

#### Disease Screenings: (Tom Gulya)

With the discovery of a new virulent mildew race in France, and the widespread occurrence of metalaxyl resistance in the US, it has become apparent that new sources of multi-race mildew resistance are necessary. In June, 2001 we requested and received all cultivated accessions that had not previously been tested for downy mildew resistance. A total of 332 accessions were received. Forty seedlings of each accession were inoculated with a mixture of two races (designated as #2760 and R-5) which together produced a virulence phenotype of "773." All 332 accessions were tested in a five week period. Of the 332 accessions, all had between 95% and 100% of the seedlings classified as susceptible. Six accessions had from 25% to 40% non-infected seedlings, and these are being retested currently to verify these results. The accessions are: Ames 14210 (Spain, CP-PB 122), Ames 18909 (VIR 171) Ames 18916 (VIR 389), Ames 18922 (VIR 429) and PI 531372 and PI 531383 (both from Hungary).

No Plant Introductions were evaluated for either Sclerotinia stalk rot or Phomopsis stem canker in 2000 or in 2001. Once a dependable field site for Sclerotinia stalk rot is found (or an artificial inoculation procedure adopted) we will commence with testing PIs again.



**2000 *HELIANTHUS* REPORT TO THE SUNFLOWER CGC**

July 14, 1999 – July 16, 2001

Mary E. Brothers, NCRPIS  
Geneticist/Sunflower Curator

**Acquisitions:**

Since the last CGC meeting, 76 *Helianthus* accessions (31 accessions of wild *Helianthus* species and 45 cultivated *H. annuus* accessions) were received and logged into GRIN. Of these new acquisitions, 27 accessions of wild *Helianthus* species were collected by Irv Larsen and M. Brothers (October 1999) from the Missouri River Valley region of western Iowa and northwestern Missouri. In 2000, Dr. Gerald Seiler and M. Brothers collected one *H. deserticola* accession and two *H. anomalous* accessions in Utah.

**Maintenance:**

The current status of the *Helianthus* collection is summarized in Table 1 and Figure 1; the status of the collection at the time of the last CGC meeting (Table 2) is provided for comparison.

In 2000, field regenerations were conducted on 96 cultivated accessions and 132 accessions of wild *Helianthus* species; greenhouse regenerations were conducted on five cultivated *Helianthus* accessions requiring a long growing season. Ninety-five cultivated accessions are planted in the field for hand pollinations this summer. In addition, two cultivated accessions will be regenerated in cages using honeybees; one of the accessions is a chrysanthemum type and the other accession is a poor pollen producer. Wild *Helianthus* regenerations conducted in 2000 and 2001 are summarized in Table 3.

A pollinator study conducted in cooperation with the Entomology team was initiated in 2000 to test the effectiveness of various *Helianthus* pollinators. The study is being repeated this summer to obtain a second year of data.

**Distribution:**

In 2000 we fulfilled a total of 47 separate *Helianthus* requests (12 foreign and 35 domestic) by distributing 1707 packets (seed and tubers) representing 1328 accessions (35% of the collection). Since January 1, 2001 we have received 45 germplasm requests (10 foreign and 35 domestic) and distributed 1422 packets representing 939 accessions (25% of the collection).

**Characterization:**

Plant and seed characterization data are recorded during the regeneration process. Characterization of *Helianthus* seed is now recorded on GRIN using an Oracle-based form developed in cooperation with Dave Kovach. The form allows for direct entry into GRIN, and various record keeping procedures related to inventory maintenance are streamlined. In 2001 we began capturing digital images (using a flatbed scanner) of *Helianthus* seed in addition to recording descriptor data. Also, we began recording digital images of *Helianthus* floral traits to use as references for characterization data.

Latitude and longitude data were added to GRIN for wild *Helianthus* accessions. Dr. Robert Webster, National Germplasm Resources Laboratory, used these data to conduct an ecogeographic assessment of wild *Helianthus* germplasm diversity.

The isozyme assessment of the genetic diversity of the 112-accession domesticated *Helianthus* core subset and a randomly selected array of 112 accessions was completed. A few rare alleles



have been identified (Figures 2 and 3); the *Helianthus* core may be modified to include the rare alleles in the randomly selected group of accessions. The isozyme data will be used to further test the validity of the core subset and to elucidate further inter- and intra- cluster relationships.

#### **GRIN updates:**

In earlier GRIN versions, a series of *Helianthus* descriptors were used to capture multiple values for a specific trait (for example, SEEDCOLOR1, SEEDCOLOR2, and SEEDCOLOR3). These descriptors were merged into a single descriptor and the primary, secondary, and tertiary values are now indicated in the frequency field. These changes make querying the database user-friendlier, especially for public database users.

The descriptor "BEHENIC" was added to the database for Behenic acid data we received from Brady Vick. "CORECLUSTER" was also added to GRIN to capture the original cluster assignment for accessions in the cultivated *Helianthus* collection from which the *Helianthus* core subset was generated.

#### **Evaluation:**

1999: *Helianthus* accessions were distributed for evaluation of resistance to rust, Sclerotinia, a sunflower virus, sunflower moth, and sunflower stem weevil. Data sets were received and entered into GRIN for percentage seed oil and fatty acid composition.

2000: *Helianthus* accessions were distributed for evaluation of resistance to *Alternaria helianthi*, *Septoria helianthi*, and sunflower moth.

2001: *Helianthus* accessions were distributed for evaluation of resistance to downy mildew and sunflower moth.

*Helianthus* evaluation data on GRIN are summarized in Table 4.

#### **Enhancement:**

Charlie Block continued an enhancement program to develop wild *H. annuus* populations resistant to *Alternaria helianthi*, *Septoria helianthi*, and powdery mildew.

#### **Future Plans:**

The isozyme data generated from the assessment of genetic diversity within the *Helianthus* core subset needs to be verified and analyzed. A publication will then be prepared.

Future applications of molecular marker technologies to the sunflower collection need to be identified and prioritized.

Continued effort will be put into obtaining caged increases from accessions maintained in the perennial *Helianthus* nursery.



Table 1. Status of the *Helianthus* collection (July 2001).

	No. of accessions	Available accessions		Accessions duplicated at NSSL		Accessions with PI numbers	
		#	%	#	%	#	%
Cultivated accessions	1662	1395	84	1525	92	1055	63
Wild accessions	2152	1127	52	1238	58	1688	78
Total collection	3814	2522	66	2764	72	2743	72

Table 2. Status of the *Helianthus* collection (June 1999).

	No. of accessions	Available accessions		Accessions duplicated at NSSL		Accessions with PI numbers	
		#	%	#	%	#	%
Cultivated accessions	1610	1323	82	1435	89	1007	63
Wild accessions	2121	966	46	1097	52	1599	75
Total collection	3731	2289	61	2532	68	2606	70

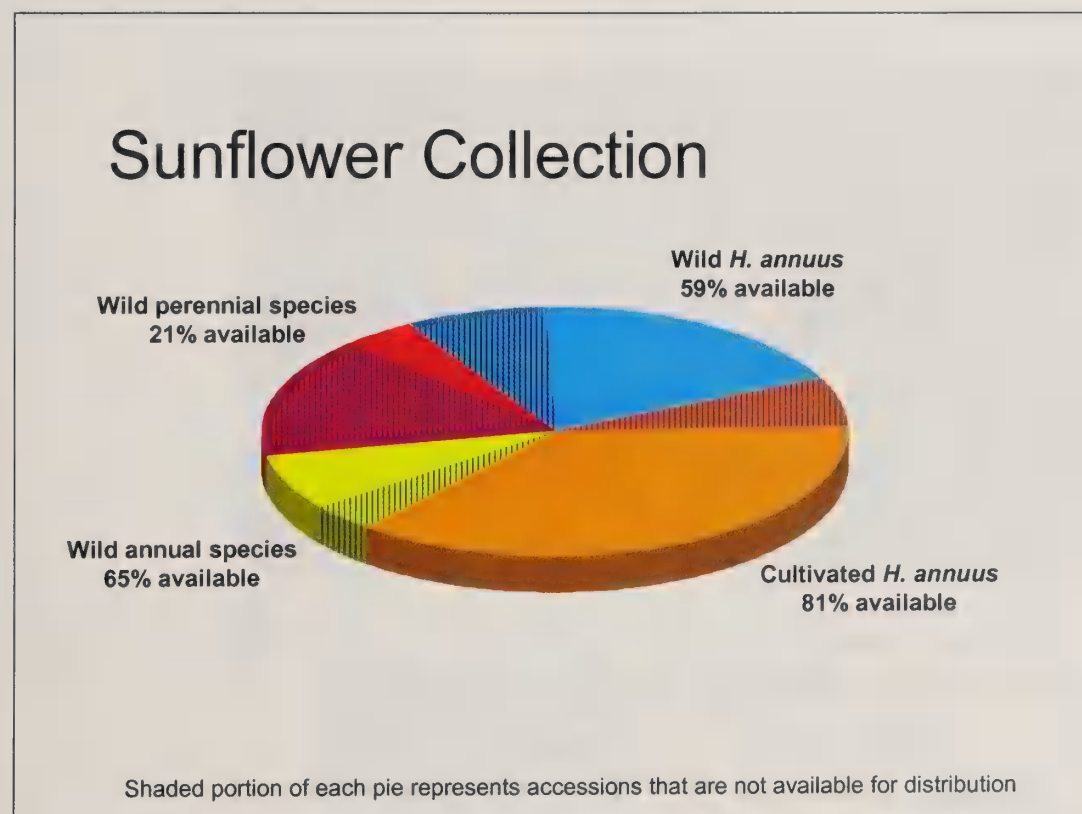


Figure 1. Availability of the *Helianthus* collection (2001).



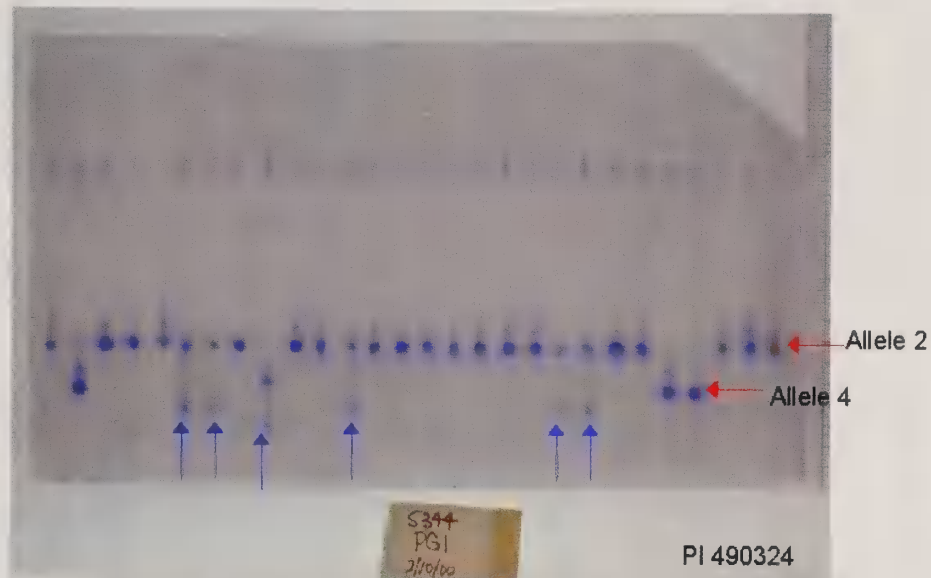


Figure 2.

- Most common *Pgi2* alleles in cultivated sunflower are alleles 2 and 4
- Unusual *Pgi2* allele(s) located at blue arrows
- PI 490324 is designated as a mutant, ornamental type from Poland
- Member of the cultivated core subset

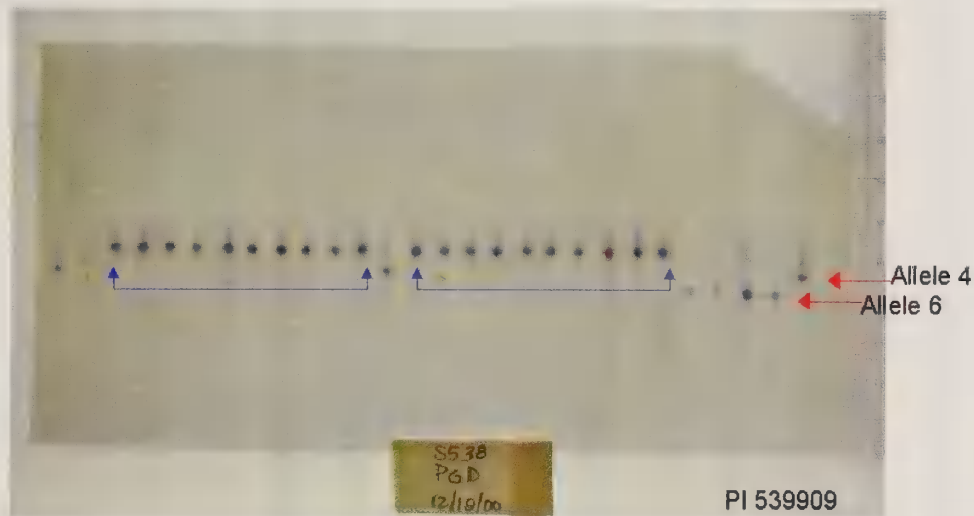


Figure 3.

- Most common *Pgd2* alleles in cultivated sunflower are alleles 4 and 6
- *Pgd2-2* (bracketed by blue arrows) was identified in wild *Helianthus* accessions from the Great Plains (frequency = 0.044)
- PI 539909 has wild *H. debilis* ssp. *silvestris* in its pedigree
- Member of the 112-randomly selected accessions



Table 3. 2000 and 2001 wild *Helianthus* regeneration attempts (NCRPIS).

Annual Species	2000 INCREASES			2001 INCREASES			
	Accessions Attempted	Insect Pollinated		Accessions Attempted	Insect Pollinated		
		Large Cage(s)			Large Cage(s)	Small Cage(s)	Greenhouse Isolation
<i>H. annuus</i>	130	120		140	95		
<i>H. argophyllus</i>				1	1		
<i>H. bolanderi</i>				1			1
<i>H. debilis</i>				1	1		
<i>H. debilis</i> ssp. <i>cucumerifolius</i>	2	2		1	1		
<i>H. deserticola</i>				1	1		
<i>H. petiolaris</i>	1						
<i>H. petiolaris</i> ssp. <i>fallax</i>	4	3					
<i>H. petiolaris</i> ssp. <i>petiolaris</i>	3	3		2	2		
Perennial species							
<i>H. ciliaris</i>	1						
<i>H. cusickii</i>	1(1) <sup>†</sup>						
<i>H. decapetalus</i>		1		1(1)	1	2	
<i>H. divaricatus</i>	2(2)						
<i>H. giganteus</i>					2		
<i>H. grosseserratus</i>					1		
<i>H. maximillianii</i>	1(1)			2(1)	1		
<i>H. mollis</i>		2		3(2)		1	
<i>H. nuttallii</i>	2(2)					1	
<i>H. nuttallii</i> ssp. <i>nuttallii</i>				1	1		
<i>H. nuttallii</i> ssp. <i>nydbergii</i>	1(1)	1					
<i>H. pauciflorus</i>						2	
<i>H. pauciflorus</i> ssp. <i>subrhomboides</i>						2	
<i>H. strumosus</i>	1(1)			4(4)	1		
<i>H. tuberosus</i>	1(1)				2		
Total	150	132		157	109	8	1

† Number (in parentheses) that have been transplanted to the field.



Table 4. Helianthus evaluation data on GRIN (July 2001).

Descriptor	Definition	# of Cultivated Accessions Evaluated	% of Cult. Collection	# of Wild Accessions Evaluated	% of Wild Collection
ALBSTMSPT	Resistance to Albugo Stem Spot	495	30		
BANDEDSUNM	% of Seed Damaged by the Banded Sunflower Moth	694	42	225	10
BEHENIC	Behenic acid percentage of oil	721	43		
DOWNYMIL2	% Resistant plants to downy mildew, race 2	244	15	43	2
DOWNYMIL3	% Resistant plants to downy mildew, race 3	229	14	36	2
DOWNYMIL4	% Resistant plants to downy mildew, race 4	833	50	138	6
LINOLEIC	Linoleic acid percentage of oil	880	53	375	17
OLEIC	Oleic acid percentage of oil	880	53	375	17
OROBANFREQ	% of plants parasitized by Orobanche	903	54		
OROBANRATE	Number of Orobanche shoots per total number of plants	903	54		
PALMITIC	Palmitic acid percentage of oil	862	52	354	16
PEROIL	Oil percentage of seed	1358	82	1128	52
PHOMOPSIS	% Resistant plants	1085	65		
RUSTMULTI	% Resistant plants	292	18		
RUSTNUM3	% Resistant plants to rust, race 3	963	58		
RUSTNUM4	% Resistant plants to rust, race 4	965	58		
SCLERBASRO	% Resistant plants to Sclerotinia basal stem rot	839	50	173	8
SCLERHDROT	% Resistant plants to Sclerotinia head rot	112	7	9	0
STEARIC	Stearic acid percentage of oil	862	52	357	17
SUNBEETLE	Number of Sun beetle larva per plant	274	16	17	1
SUNMOTH	Resistance to sunflower moth	88	5		
WHITERUST	Resistance to white rust	1064	64		



## **REPORT ON THE STATUS OF THE SUNFLOWER GERMPLASM IN THE U.S.**

Sunflower is one of the four most important annual oilseed crops grown for edible oil. It is also the second largest hybrid crop grown in the world. U.S. production in 1999 was estimated at 3.6 million acres with an estimated total economic impact of \$2.6 billion. The ultimate goal of the entire sunflower germplasm effort is the enhancement and development of superior germplasm for the producer to insure a continued and viable industry.

### **PRESENT GERMPLASM ACTIVITIES**

The North Central Regional Plant Introduction Station, Ames, Iowa has the responsibility for the maintenance and distribution of the sunflower germplasm collection. Evaluation of the collection is being conducted by the Plant Introduction Station, the Agricultural Research Service (ARS), State Universities/Experiment Stations, and various cooperators around the world depending on the expertise and environments needed to evaluate for various characteristics.

### **STATUS OF CROP VULNERABILITY**

Sunflower hybrids grown in the U.S. are based on a single male-sterile cytoplasm derived from wild *Helianthus petiolaris* which makes them extremely vulnerable. Hybrids are also vulnerable to many insect and disease pests.

### **GERMPLASM NEEDS— COLLECTION**

Sunflower is unique in that it is one of the four crop species which has its progenitor species native to the U.S. The genus *Helianthus* contains 50 species and 15 subspecies which offer genetic diversity for many agronomic characteristics for the improvement and expansion of cultivated sunflower. The present germplasm collection is representative of all extant species and subspecies, but does not come close to adequately representing the potentially available genetic diversity that needs to be conserved. Continued efforts are needed to strive toward collecting as many populations of all species as are feasible. Since Mexico has not been systematically collected, this area represents a wealth of genetic variation and should be collected as soon as possible. Due to the persistent *Sclerotinia* disease complex, emphasis will be put on collecting selected perennial species in the U.S. In the future, collections will be based on species specific needs, instead of collecting all species from a general area.



## GERMPLASM NEEDS— MAINTENANCE

The seed multiplication program is the most valuable link of the *Helianthus* germplasm program. There is a critical need to regenerate and replenish wild *Helianthus* seed stocks. The number of accessions waiting to be regenerated is large. Until accessions are regenerated, this produces a bottleneck in the evaluation process. Due to the large number of wild perennial accessions waiting to be regenerated, and the difficulty in obtaining an adequate number of plants for regeneration, *in situ* conservation should be considered as a maintenance option.

## GERMPLASM NEEDS— EVALUATION

An evaluation plan for disease and insect pests listing priorities for evaluation is in place. Evaluation information obtained to date has been a valuable addition to the GRIN system in characterizing the value of germplasm accessions. There is a continued need to evaluate more accessions as pest races change and the continuing need to evaluate additional species populations and accessions. Priority descriptors of the accessions of the wild species continue to be collected in an effort to make the information available in the GRIN system. There is a particular need for additional funds to evaluate the wild perennial species for *Sclerotinia* stem and stalk rots, and screening of wild species for *Rhizopus* head rot resistance, a persistent and increasing problem in the High Plains.

## GERMPLASM NEEDS— ENHANCEMENT

Increasing genetic variability of cultivated sunflower is critical for ensuring survival of the crop. An enhancement plan is in place for the inclusion of wild *Helianthus* species into a domesticated background utilizing embryo rescue and other techniques. The plan includes interspecific gene transfer, germplasm pool development, and development of cytoplasmic male-sterility and fertility restoration programs. Based on current needs, crossing wild perennial species into the cultivated background is necessary since many of the perennial species have shown promise as potential sources of genes for resistance to some of the persistent pests. There is critical need to utilize the molecular characterization techniques available to facilitate the difficult task of transferring genes from the wild perennial species into cultivated sunflower.

## RECOMMENDATIONS

The priority needs and actions for the *Helianthus* germplasm collection are as follows:

1. **Fund an exploration to explore the wealth of genetic variability in the wild species of Mexico.**
2. **Provide funding to the Plant Introduction Station to build a greenhouse complex to increase the number of accession regenerations that require special conditions.**
3. **Provide \$50,000 for evaluation of wild perennial species for resistance to the *Sclerotinia* disease complex and wild species for *Rhizopus* head rot resistance.**
4. **Provide funding for a Category I scientist to facilitate the use of molecular technology in the gene transfer from wild perennial species into cultivated sunflower.**
5. **The Committee strongly supports the activities of the NPGS site at Parlier, CA as an alternate grow-out site and encourages exploring the opportunities to utilize it as an alternate site for difficult to regenerate sunflower accessions.**



2001 Report of the National Germplasm Resources Laboratory, Beltsville, MD to the Regional Plant Introduction Station and NRSP-6 Technical Advisory Committees

**Germplasm Resources Information Network:**

The GRIN/Database Management Unit (DBMU) suffered a significant loss in January 2001, when Dr. Edward Bird, who had served as the Database Administrator since 1988, passed away following a several month illness. Subsequently, Dr. Quinn Sinnott, who had served as Ed's backup, was promoted into the DBA position.

GRIN continues to serve the U.S. National Plant Germplasm System (NPGS) by facilitating access to information important for the management and use of the germplasm collections. The NPGS web pages receive about 600 visits and generate 4,500 database queries each day. Scientists using pcGRIN continue to have the option of requesting data on diskettes from the DBMU or downloading updated data from the web.

Security of the GRIN data and operating systems is a high priority for the DBMU. Access to the database by mischievous or malicious intruders is filtered out with a firewall and packet filtering by routers. NPGS site personnel are required to change passwords periodically to lessen the chance that a password is compromised. All GRIN data are backed up daily and copies are routinely stored offsite. New versions of software are tested on a separate server to ensure that any anomalies surface before they are installed on the production servers.

Development of a new graphical interface for the plant database is progressing. NPGS site personnel will evaluate and be trained on the use of the new software in February 2002.

GRIN is currently using Sun Microsystems' Solaris 8 operating system and Oracle Version 8i Release 3 software. The DBMU routinely reviews new Sun and Oracle software releases to assess the advisability of upgrading. The practice of software and hardware manufacturers discontinuing service to older versions of products makes this particularly important. ARS continues to support the timely replacement of GRIN hardware, which is critical to ensuring the stability of the information system.

Germplasm accessions acquired by the NPGS since the effective date of the Convention on Biological Diversity have been tagged with appropriate disclaimers in GRIN. Disclaimers are displayed with accession passport data and automatically printed on GRIN generated packing slips when accessions are distributed. During the past year, the DBMU helped NPGS sites load passport and evaluation data and images into the database. The latter included large numbers of amaranth, brassica, millet, and sorghum pictures. NPGS personnel from the Davis, Parlier, and Palmer sites were trained in various aspects of GRIN usage.

The DBMU continued to cooperate with the International Plant Genetic Resources Institute (IPGRI) by providing the pcGRIN data management software to national genebanks in all Central and South America and Caribbean nations and participating in workshops to train their



personnel in its use. Additional training sessions are scheduled in Guyana, Mexico, and Benin during 2001. The latter is in response to interest that several West African nations have expressed in using pcGRIN to document their germplasm collections.

GRIN was demonstrated at the ASA annual meeting, and several Crop Germplasm Committee and commodity meetings. The Directory of NPGS Personnel and Committees was added to the GRIN web page in a PDF format.

Support of the animal, beneficial insect and microbial genetic resources programs continued. The DBMU developed inventory modules to document the animal germplasm being stored at Ft. Collins, CO and work continued on the Release of Beneficial Organisms database.

#### **Plant Exchange Office (PEO):**

The PEO facilitated distribution of germplasm from NPGS sites to foreign researchers and genebanks. During the year, the PEO obtained phytosanitary certificates and forwarded 404 shipments, containing 28,833 accessions, to 64 countries. Eighty one shipments of 1,602 accessions were received from 41 countries, inspected and forwarded to appropriate NPGS sites, scientists, or quarantine facility.

In FY 2000, 396 non-site specific web requests for germplasm were received by the PEO and forwarded to NPGS sites, or alternate sources for the germplasm were located when the requested items were not in NPGS inventories. Sixteen requests were received via regular mail or fax and forwarded to appropriate NPGS sites.

The PEO continued to review accession data entered in GRIN and assign permanent Plant Introduction (PI) accession numbers. PI numbers were assigned to 2,812 accessions including 368 Crop Science Registration and 333 Plant Variety Protection accessions. The USDA, Plant Inventory, which contains passport data on accessions introduced into the NPGS the previous year, is now available via the Internet and accessible through the NPGS website. Hard copies of the Inventory, which was first published in 1899, are no longer being produced because of printing and distribution costs and the availability of electronic information exchange.

The PEO provided funding for 1 plant exchange and 9 plant exploration trips in FY 2000. In FY 2001, 1 exchange and 8 exploration trips are being supported. Trips to collect forage and turf grasses in Chile, cool-season grasses in Argentina, and *Solanum* sp. in Peru have been postponed.

Guidelines for exploration and exchange proposals are available from the PEO. The deadline for submission of final proposals for FY 2002 is July 1, 2001. The submission of brief pre-proposals by April 15 is now being suggested so that the PEO can help contact host country authorities responsible for granting access to germplasm and establish terms of exchange agreements.



## USDA/ARS Plant Explorations Undertaken in FY 2000

Plant Exploration	Country	Principal Contacts
Tussac Grass	South Georgia	S. Wright
<i>Arachis hypogaea</i>	Guatemala	C. Azurdia, D. Williams, K. Williams, H. Ayala
<i>Zea luxurians</i>	Nicaragua	R. Bird, C. Loaisiga, A. Grijalva
<i>Spinacea turkestanica</i>	Turkmenistan	K. Mamedov, M. Dourikov
<i>Solanum</i> spp.	Honduras, Panama	D. Spooner, A. Lopez, K. Chambers, C. Valladares
<i>Prunus</i> spp. (exchange)	People's Rep. Of China	D. Byrne, D. Ramming
Forage Legumes and Vegetables	Kazakhstan	R. Hannan, S. Greene, S. Khusainov, A. Afonin
<i>Trifolium wigginsii</i>	Mexico	N. Taylor, W. Graves, J. Delgadillo
Grasses and forage legumes	People's Rep. Of China	D. Johnson, D. Miller
<i>Helianthus</i> spp.	United States	G. Seiler, M. Brothers

## USDA/ARS Plant Explorations Planned/Undertaken in FY 2001

Plant Exploration	Country	Principal Contacts
Pear and small fruit	Russia	K. Hummer, N. Vorsa, A. Sabitov, P. Chebukin
<i>Daucus</i> spp.	Portugal, France, Spain	P. Simon, M. Briard, A. Pujadas-Salva
Breadfruit (exchange)	Samoa, Tahiti	D. Ragone, D. Lorence
Tomato	Chile	R. Chetelat, R. Pertuzé, L. Faúndez
Forages and vegetables	Armenia	R. Hannan, W. Kaiser
<i>Spinacia tetandra</i>	Georgia	M. Akhalkatsi, M. Mosulishvili
Cucurbits	Zimbabwe	A. Mafa
Multiple crops	Guyana	K. Williams, D. Williams, L. Guarino, C. Paul
<i>Allium vavilovii</i>	Turkmenistan	G. Kamakhina

Collaborative projects with IPGRI; the Bureau of National Parks and Wildlife, Paraguayan Ministry of Agriculture; and Fundación Amigos de la Naturaleza and the Museo de Historia Natural Noel Kempff Mercado, Santa Cruz, Bolivia. to inventory wild crop relatives in Paraguay and Bolivia are nearing completion. A database was developed to facilitate the recording of herbarium and germplasm collection records, and taxonomic literature. The distribution and diversity of crop relatives, and their coincidence with protected areas is being analyzed. Results will be presented as national atlases of wild crop relatives and recommendations will be made to the national authorities on *in situ* management.

A cooperative project was completed with the University of San Carlos Genebank, Guatemala City, Guatemala, to increase and characterize peanut landraces collected in 1997 and 1999. Characterization data will be recorded in GRIN.

In March 2001, Karen Williams collaborated with IPGRI and the National Agricultural Research Institute of Guyana in presenting a short training course in plant genetic resources conservation to Guyanese scientists from several institutions. Plans were made for a September 2001 expedition in Guyana to collect several of their native crops not represented in germplasm collections.



A project was developed with the Hebron and Tel Aviv Universities, to collect and preserve traditional Palestinian spices and related indigenous taxa. The project is on hold due to current political unrest in the region. The PEO and the Corvallis, OR, National Clonal Repository established collaboration with the Institute for Fruit Growing in Alma Ata, Kazakhstan on collection and *in vitro* preservation of fruits. This project is funded by the International Science and Technology Center, a US/Russian Federation program to utilize former weapons scientists for peaceful purposes.

The PEO is cooperating with the Indian National Bureau of Plant Genetic Resources, Tropical Repository in Thrissur on two USDA/FAS funded projects to regenerate, evaluate, and preserve germplasm *in-vitro*. The USDA/FAS also funded a project with the Bangladesh Agricultural University to collect and evaluate traditional and indigenous fruits and vegetables of Bangladesh.

The PEO continued to support the American Association of Botanic Gardens and Arboreta/ North American Plant Collections Consortium. The Association's interest remains high in having its member institutions participate in the consortium and cooperate with the NPGS in collecting, documenting, and preserving germplasm.

#### **Assessment and Prioritization of NPGS Germplasm Needs:**

Preliminary assessments are being made of acquisition needs for important crop species and their wild relatives. The number and origin of wild collected NPGS accessions and the climatic and geophysical variation within geographic ranges of species within crop gene pools are being considered. Significant enhancements were completed on the GIS databases and procedures used for defining germplasm needs. Approximately 500 original GIS climatic images were produced using the best available data and kriging procedures. Using the enhanced databases, data were updated for the taxa *Aegilops*, *Hordeum*, and *Avena*. A report was completed for the 60 *Helianthus* taxa and a paper was published. Significant progress was made on the application of the procedures to treatments of 62 recognized taxa of *Phaseolus*, 15 taxa of *Beta*, and 14 taxa of *Malus*.

The procedures and results of the research were presented at the annual meetings of the Crop Science Society of America and the Sunflower Association, the Barley CGC meeting, a meeting of University of Minnesota and ARS cereal researchers, and a NPGS GIS workshop. Collaborations were established and maintained with numerous federal and state scientists with similar interest in the distribution of genetic diversity of crops and crop relatives.

#### **Crop Germplasm Committee Facilitation:**

Since June 1, 2000, 35 of the 40 Crop Germplasm Committees (CGC) have met. An NGRL representative was present at 28 of the meetings to help facilitate their activities. In July 2000, the NGRL hosted the 8th biennial meeting of the CGC chairs. This meeting provided an opportunity for Chairs to hear presentations relevant to plant germplasm exchange, preservation and utilization, and to meet and interact with each other, NPGS managers and curators, and invited guests from ARS, other government agencies, and non-government organizations.



July 7, 2000

REPORT 1

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## Helianthus Accessions Maintained in the NPGS

Taxonomic Name	NPGS Site	TOTAL
Helianthus agrestis	NC7	5
Helianthus angustifolius	NC7	19
Helianthus annuus	NC7	2,627
Helianthus annuus	NSSL	206
Helianthus anomalus	NC7	10
Helianthus argophyllus	NC7	48
Helianthus arizonensis	NC7	2
Helianthus atrorubens	NC7	17
Helianthus bolanderi	NC7	17
Helianthus californicus	NC7	2
Helianthus carnosus	NC7	1
Helianthus ciliaris	NC7	6
Helianthus cusickii	NC7	4
Helianthus debilis	NC7	1
Helianthus debilis subsp. cucumerifolius	NC7	7
Helianthus debilis subsp. debilis	NC7	26
Helianthus debilis subsp. silvestris	NC7	22
Helianthus debilis subsp. tardiflorus	NC7	5
Helianthus debilis subsp. vestitus	NC7	3
Helianthus decapetalus	NC7	33
Helianthus deserticola	NC7	11
Helianthus divaricatus	NC7	42
Helianthus eggertii	NC7	2
Helianthus floridanus	NC7	5
Helianthus giganteus	NC7	30
Helianthus glaucophyllus	NC7	2
Helianthus gracilentus	NC7	6
Helianthus grosseserratus	NC7	49
Helianthus heterophyllus	NC7	9
Helianthus hirsutus	NC7	21
Helianthus hybrid	NC7	22
Helianthus hybrid	NSSL	2
Helianthus laevigatus	NC7	8
Helianthus longifolius	NC7	1
Helianthus maximiliani	NC7	80
Helianthus microcephalus	NC7	16
Helianthus mollis	NC7	30
Helianthus neglectus	NC7	28
Helianthus niveus subsp. canescens	NC7	16
Helianthus niveus subsp. tephrodes	NC7	3
Helianthus nuttallii	NC7	11
Helianthus nuttallii subsp. nuttallii	NC7	22
Helianthus nuttallii subsp. rydbergii	NC7	12
Helianthus occidentalis	NC7	1
Helianthus occidentalis subsp. occidentalis	NC7	2
Helianthus occidentalis subsp. plantagineus	NC7	14
Helianthus paradoxus	NC7	10
Helianthus pauciflorus	NC7	12
Helianthus pauciflorus subsp. pauciflorus	NC7	13
Helianthus pauciflorus subsp. subrhomboideus	NC7	19
Helianthus petiolaris	NC7	15



## Helianthus Accessions Maintained in the NPGS

Taxonomic Name	NPGS Site	TOTAL
Helianthus petiolaris subsp. fallax	NC7	31
Helianthus petiolaris subsp. petiolaris	NC7	106
Helianthus praecox	NC7	2
Helianthus praecox subsp. hirtus	NC7	8
Helianthus praecox subsp. praecox	NC7	8
Helianthus praecox subsp. runyonii	NC7	24
Helianthus pumilus	NC7	6
Helianthus radula	NC7	18
Helianthus resinosus	NC7	10
Helianthus salicifolius	NC7	3
Helianthus schweinitzii	NC7	1
Helianthus silphioides	NC7	5
Helianthus simulans	NC7	4
Helianthus smithii	NC7	2
Helianthus sp.	NC7	14
Helianthus strumosus	NC7	42
Helianthus tuberosus	NC7	115
Helianthus x laetiflorus	NC7	12
Helianthus x multiflorus	NC7	1
		-----
		3,987



## Helianthus Accessions by Country

Taxonomic Name	Country	TOTAL
Helianthus agrestis	United States	5
Helianthus angustifolius	United States	19
Helianthus annuus	Afghanistan	2
Helianthus annuus	Argentina	45
Helianthus annuus	Australia	5
Helianthus annuus	Austria	2
Helianthus annuus	Brazil	2
Helianthus annuus	Bulgaria	13
Helianthus annuus	Canada	119
Helianthus annuus	Chile	7
Helianthus annuus	China	22
Helianthus annuus	Colombia	3
Helianthus annuus	Cuba	1
Helianthus annuus	Czechoslovakia	3
Helianthus annuus	Egypt	4
Helianthus annuus	Ethiopia	6
Helianthus annuus	Former Soviet Union	148
Helianthus annuus	France	25
Helianthus annuus	Georgia	1
Helianthus annuus	Germany	46
Helianthus annuus	Hungary	83
Helianthus annuus	India	3
Helianthus annuus	Indonesia	1
Helianthus annuus	Iran	61
Helianthus annuus	Iraq	10
Helianthus annuus	Israel	3
Helianthus annuus	Italy	3
Helianthus annuus	Jordan	12
Helianthus annuus	Kazakhstan	1
Helianthus annuus	Kenya	17
Helianthus annuus	Korea, North	1
Helianthus annuus	Lebanon	1
Helianthus annuus	Lithuania	1
Helianthus annuus	Mexico	20
Helianthus annuus	Monaco	1
Helianthus annuus	Morocco	2
Helianthus annuus	Netherlands	4
Helianthus annuus	Pakistan	5
Helianthus annuus	Paraguay	1
Helianthus annuus	Peru	1
Helianthus annuus	Poland	38
Helianthus annuus	Portugal	1
Helianthus annuus	Rhodesia	3
Helianthus annuus	Romania	46
Helianthus annuus	Russian Federation	90
Helianthus annuus	South Africa	12
Helianthus annuus	Spain	107
Helianthus annuus	Sweden	1
Helianthus annuus	Syria	2
Helianthus annuus	Tanzania	1
Helianthus annuus	Turkey	122



## Helianthus Accessions by Country

Taxonomic Name	Country	TOTAL
Helianthus annuus	Ukraine	16
Helianthus annuus	Uncertain	54
Helianthus annuus	United Kingdom	3
Helianthus annuus	United States	1,500
Helianthus annuus	Unknown	8
Helianthus annuus	Uruguay	7
Helianthus annuus	Yugoslavia	73
Helianthus annuus	Zambia	28
Helianthus annuus	Zimbabwe	36
Helianthus anomalus	United States	10
Helianthus argophyllus	Former Soviet Union	2
Helianthus argophyllus	Mozambique	1
Helianthus argophyllus	United States	45
Helianthus arizonensis	United States	2
Helianthus atrorubens	United States	17
Helianthus bolanderi	United States	17
Helianthus californicus	United States	2
Helianthus carnosus	United States	1
Helianthus ciliaris	United States	5
Helianthus ciliaris	No Data Available	1
Helianthus cusickii	United States	4
Helianthus debilis	Netherlands	1
Helianthus debilis subsp. cucumerifolius	United States	7
Helianthus debilis subsp. debilis	United States	26
Helianthus debilis subsp. silvestris	United States	22
Helianthus debilis subsp. tardiflorus	United States	5
Helianthus debilis subsp. vestitus	United States	3
Helianthus decapetalus	Canada	2
Helianthus decapetalus	United States	30
Helianthus decapetalus	Unknown	1
Helianthus deserticola	United States	11
Helianthus divaricatus	Canada	1
Helianthus divaricatus	United States	39
Helianthus divaricatus	Unknown	2
Helianthus eggertii	United States	2
Helianthus floridanus	United States	5
Helianthus giganteus	Canada	2
Helianthus giganteus	United States	26
Helianthus giganteus	Unknown	2
Helianthus glaucophyllus	United States	2
Helianthus gracilentus	United States	6
Helianthus grosseserratus	United States	48
Helianthus grosseserratus	Unknown	1
Helianthus heterophyllus	United States	9
Helianthus hirsutus	United States	21
Helianthus hybrid	Argentina	2
Helianthus hybrid	Former Soviet Union	2
Helianthus hybrid	Germany	1
Helianthus hybrid	Portugal	1
Helianthus hybrid	Russian Federation	2
Helianthus hybrid	United States	16



## Helianthus Accessions by Country

Taxonomic Name	Country	TOTAL
Helianthus laevigatus	United States	8
Helianthus longifolius	United States	1
Helianthus maximilianii	Canada	13
Helianthus maximilianii	United States	66
Helianthus maximilianii	Unknown	1
Helianthus microcephalus	United States	16
Helianthus mollis	United States	28
Helianthus mollis	Unknown	2
Helianthus neglectus	United States	28
Helianthus niveus subsp. canescens	Mexico	1
Helianthus niveus subsp. canescens	United States	15
Helianthus niveus subsp. tephrodes	Mexico	1
Helianthus niveus subsp. tephrodes	United States	2
Helianthus nuttallii	Canada	4
Helianthus nuttallii	United States	6
Helianthus nuttallii	Unknown	1
Helianthus nuttallii subsp. nuttallii	United States	22
Helianthus nuttallii subsp. rydbergii	Canada	8
Helianthus nuttallii subsp. rydbergii	United States	4
Helianthus occidentalis	United States	1
Helianthus occidentalis subsp. occidentalis	United States	2
Helianthus occidentalis subsp. plantagineus	United States	14
Helianthus paradoxus	United States	10
Helianthus pauciflorus	Canada	5
Helianthus pauciflorus	United States	6
Helianthus pauciflorus	Unknown	1
Helianthus pauciflorus subsp. pauciflorus	United States	13
Helianthus pauciflorus subsp. subrhomboides	United States	19
Helianthus petiolaris	United States	15
Helianthus petiolaris subsp. fallax	United States	31
Helianthus petiolaris subsp. petiolaris	Canada	6
Helianthus petiolaris subsp. petiolaris	United States	100
Helianthus praecox	United States	2
Helianthus praecox subsp. hirtus	United States	8
Helianthus praecox subsp. praecox	United States	8
Helianthus praecox subsp. runyonii	United States	24
Helianthus pumilus	United States	5
Helianthus pumilus	No Data Available	1
Helianthus radula	United States	18
Helianthus resinosus	United States	10
Helianthus salicifolius	United States	2
Helianthus salicifolius	Unknown	1
Helianthus schweinitzii	United States	1
Helianthus silphioides	United States	5
Helianthus simulans	United States	4
Helianthus smithii	United States	2
Helianthus sp.	Australia	1
Helianthus sp.	Mongolia	2
Helianthus sp.	Uncertain	4
Helianthus sp.	United States	7
Helianthus strumosus	United States	41



## Helianthus Accessions by Country

Taxonomic Name	Country	TOTAL
Helianthus strumosus	Unknown	1
Helianthus tuberosus	Argentina	1
Helianthus tuberosus	Canada	3
Helianthus tuberosus	Former Soviet Union	8
Helianthus tuberosus	Uncertain	1
Helianthus tuberosus	United States	100
Helianthus tuberosus	Unknown	2
Helianthus x laetiflorus	United States	10
Helianthus x laetiflorus	Unknown	2
Helianthus x multiflorus	Unknown	1
		-----
		3,987



July 7, 2000

REPORT 3

page 1

Helianthus Accessions Maintained Only at NSSL

Taxonomic Name	TOTAL
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Helianthus annuus	206
Helianthus hybrid	2
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	208



July 7, 2000

REPORT 4

page 1

Core Collection Status for Helianthus

Taxonomic Name	TOTAL
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Helianthus annuus	112
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	112



## Backup Status of Helianthus Accessions in the NPGS

TAXON	SITE	NSSL	SITE	NOT	TOTAL
		BACK UP	BACK UP	BACKED UP	
<i>Helianthus agrestis</i>	NC7	2	0	3	5
<i>Helianthus angustifolius</i>	NC7	1	0	18	19
<i>Helianthus annuus</i>	NC7	2,130	0	497	2,627
<i>Helianthus annuus</i>	NSSL	0	0	206	206
<i>Helianthus anomalus</i>	NC7	0	0	10	10
<i>Helianthus argophyllus</i>	NC7	16	0	32	48
<i>Helianthus arizonensis</i>	NC7	0	0	2	2
<i>Helianthus atrorubens</i>	NC7	4	0	13	17
<i>Helianthus bolanderi</i>	NC7	0	0	17	17
<i>Helianthus californicus</i>	NC7	0	0	2	2
<i>Helianthus carnosus</i>	NC7	0	0	1	1
<i>Helianthus ciliaris</i>	NC7	1	0	5	6
<i>Helianthus cusickii</i>	NC7	1	0	3	4
<i>Helianthus debilis</i>	NC7	0	0	1	1
<i>Helianthus debilis</i> subsp. <i>cucumerifolius</i>	NC7	6	0	1	7
<i>Helianthus debilis</i> subsp. <i>debilis</i>	NC7	11	0	15	26
<i>Helianthus debilis</i> subsp. <i>silvestris</i>	NC7	22	0	0	22
<i>Helianthus debilis</i> subsp. <i>tardiflorus</i>	NC7	5	0	0	5
<i>Helianthus debilis</i> subsp. <i>vestitus</i>	NC7	3	0	0	3
<i>Helianthus decapetalus</i>	NC7	10	0	23	33
<i>Helianthus deserticola</i>	NC7	0	0	11	11
<i>Helianthus divaricatus</i>	NC7	9	0	33	42
<i>Helianthus eggertii</i>	NC7	0	0	2	2
<i>Helianthus floridanus</i>	NC7	1	0	4	5
<i>Helianthus giganteus</i>	NC7	10	0	20	30
<i>Helianthus glaucophyllus</i>	NC7	0	0	2	2
<i>Helianthus gracilentus</i>	NC7	0	0	6	6
<i>Helianthus grosseserratus</i>	NC7	20	0	29	49
<i>Helianthus heterophyllus</i>	NC7	0	0	9	9
<i>Helianthus hirsutus</i>	NC7	1	0	20	21
<i>Helianthus hybrid</i>	NC7	13	0	9	22
<i>Helianthus hybrid</i>	NSSL	0	0	2	2
<i>Helianthus laevigatus</i>	NC7	0	0	8	8
<i>Helianthus longifolius</i>	NC7	0	0	1	1
<i>Helianthus maximilianii</i>	NC7	49	0	31	80
<i>Helianthus microcephalus</i>	NC7	0	0	16	16
<i>Helianthus mollis</i>	NC7	4	0	26	30
<i>Helianthus neglectus</i>	NC7	27	0	1	28
<i>Helianthus niveus</i> subsp. <i>canescens</i>	NC7	14	0	2	16
<i>Helianthus niveus</i> subsp. <i>tephrodes</i>	NC7	1	0	2	3
<i>Helianthus nuttallii</i>	NC7	4	0	7	11
<i>Helianthus nuttallii</i> subsp. <i>nuttallii</i>	NC7	14	0	8	22
<i>Helianthus nuttallii</i> subsp. <i>rydbergii</i>	NC7	11	0	1	12
<i>Helianthus occidentalis</i>	NC7	0	0	1	1
<i>Helianthus occidentalis</i> subsp. <i>occidentalis</i>	NC7	1	0	1	2
<i>Helianthus occidentalis</i> subsp. <i>plantagineus</i>	NC7	9	0	5	14
<i>Helianthus paradoxus</i>	NC7	2	0	8	10
<i>Helianthus pauciflorus</i>	NC7	5	0	7	12
<i>Helianthus pauciflorus</i> subsp. <i>pauciflorus</i>	NC7	2	0	11	13
<i>Helianthus pauciflorus</i> subsp. <i>subrhomboideus</i>	NC7	9	0	10	19



## REPORT 5

## Backup Status of Helianthus Accessions in the NPGS

TAXON	SITE	NSSL BACK UP	SITE BACK UP	NOT BACKED UP	TOTAL
Helianthus petiolaris	NC7	12	0	3	15
Helianthus petiolaris subsp. fallax	NC7	28	0	3	31
Helianthus petiolaris subsp. petiolaris	NC7	86	0	20	106
Helianthus praecox	NC7	2	0	0	2
Helianthus praecox subsp. hirtus	NC7	7	0	1	8
Helianthus praecox subsp. praecox	NC7	8	0	0	8
Helianthus praecox subsp. runyonii	NC7	24	0	0	24
Helianthus pumilus	NC7	2	0	4	6
Helianthus radula	NC7	2	0	16	18
Helianthus resinosus	NC7	0	0	10	10
Helianthus salicifolius	NC7	0	0	3	3
Helianthus schweinitzii	NC7	1	0	0	1
Helianthus silphioides	NC7	0	0	5	5
Helianthus simulans	NC7	2	0	2	4
Helianthus smithii	NC7	0	0	2	2
Helianthus sp.	NC7	10	0	4	14
Helianthus strumosus	NC7	8	0	34	42
Helianthus tuberosus	NC7	17	0	98	115
Helianthus x laetiflorus	NC7	1	0	11	12
Helianthus x multiflorus	NC7	0	0	1	1
		2,628	0	1,359	3,987



## Total Number of SUNFLOWER Accessions Evaluated

Descriptor and Qualifier Name	TOTAL
100_SEED_WEIGHT	3,138
ALBUGO STEM SPOT	495
BANDED SUN_MOTH	919
BEHENIC ACID	721
BRACT TIGHT	1,438
BRANCHING1	771
BRANCHING2	562
BRANCHING3	199
BRANCHING4	235
BRANCHING5	437
COMMENT FIELD	276
CORE CLUSTER	1,165
CORE SUBSET	112
DAY_FLOW	1,468
DAY_FLOW_UNIF	1,130
DOWNY MILDEW RACE 2	287
DOWNY MILDEW RACE 3	265
DOWNY MILDEW RACE 4	971
HEAD DIAMETER (HIGH RANGE)	671
HEAD DIAMETER (LOW RANGE)	649
HEAD_SHAPE_VAR	957
LINOLEIC	1,270
MAXIMUM PLANT HEIGHT	702
MINIMUM PLANT HEIGHT	633
OLEIC	1,270
OROBANCHE ATTACKING RATE	903
OROBANCHE FREQUENCY	903
PALMITIC	1,231
PER_OIL	2,494
PHOMA BLIGHT	499
PHOMOPSIS	1,085
PLT_HGT_VAR	815
POLLEN_COLOR	1,437
POP_SIZE	196
PREDOMINANT HEAD SHAPE	1,144
PRIMARY SEED LENGTH	1,397
PRIMARY SEED PUBESCENCE	1,642
PRIMARY SEED SHAPE	1,394
PRIMARY SEED STRIPE POSITION	1,511
PRIMARY SEED WIDTH	1,399
RAY FLOWER PETAL CURLING	1,447
RAY_FLOW_COLOR	1,468
RAY_FLOW_NUM	1,461
RAY_FLOW_SHAPE	1,475
RED SEED WEEVIL	692
RUST - MULTIPLE RACES	292
RUST RACE 3	963
RUST RACE 4	965
SCLER_BASALSTEM_ROT	1,012
SCLER_HEAD_ROT	121
SECONDARY HEAD SHAPE	646



## Total Number of SUNFLOWER Accessions Evaluated

Descriptor and Qualifier Name	TOTAL
SECONDARY SEED LENGTH	352
SECONDARY SEED PUBESCENCE	78
SECONDARY SEED SHAPE	548
SECONDARY SEED STRIPE POSITION	408
SECONDARY SEED WIDTH	514
SEED LENGTH	1,398
SEED PUBESCENCE	1,642
SEED SHAPE	1,395
SEED STRIPE POSITION	1,511
SEED WIDTH	1,399
SEED_COLOR	1,939
SEED_COLOR1	1,939
SEED_COLOR2	1,201
SEED_COLOR3	490
SEED_MOTTILING	1,937
SEED_PIG_ANTH	1,920
SEED_SIZE1	842
SEED_SIZE2	745
SEED_STRIPES	1,926
SEED_STRIPE_COLOR	1,502
SEED_STRIPE_COLOR1	1,500
SEED_STRIPE_COLOR2	726
SEED_STRIPE_COLOR3	209
SEED_THICK	1,394
STEARIC	1,234
STEM_CURVE	806
STEM_CHAR	74
STIGMA_COLOR	1,442
SUN_BEETLE	291
SUN_MOTH	88
TOTAL STEM LENGTH (HIGH RANGE)	1,218
TOTAL STEM LENGTH (LOW RANGE)	1,209
WHITE RUST	1,064



# PLANT EXPLORATION REPORT

## UTAH, ARIZONA, AND NEVADA, USA

### SEPTEMBER 2000





**SUNFLOWER PLANT EXPLORATION REPORT  
UTAH, ARIZONA, AND NEVADA, USA  
SEPTEMBER 2000  
(SUMMARY)**

**Participants:**

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Iowa State University  
Ames, Iowa 50011  
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E-mail: Mbrothers@ncrpis-1.agron.iastate.edu

**States Visited:**

Utah, Arizona, and Nevada.

**Dates of Travel:** September 16 - September 23, 2000

**Objectives:**

To collect accessions of selected wild sunflower taxa for potential use for improving sunflower germplasm with drought tolerance, disease and insect tolerance, and oil quality characteristics. Taxa expected to be collected included: *Helianthus anomalous* and *H. deserticola*.

**Accomplishments:**

Three accessions of wild sunflower were collected during the exploration. All known populations (over 25) of the selected species were visited. Good seed collections were made from three populations. These accessions will replenish the seed stocks in the sunflower germplasm collection and make them available for distribution. Presently no seed of either species is available for distribution. The fresh seed supply will also offer the opportunity to evaluate regeneration possibilities for these species at an alternate regeneration site at Parlier, Ca.

## Narrative Report

The exploration covered 2550 miles (4080 km), three states, Utah, Arizona, and Nevada, and 7 days of actual collecting. Three accessions were added to the NPGS wild sunflower germplasm collection at Ames, Iowa. Seed collections were made from all populations. In general, seed set appeared to be good, with adequate seed being collected from all populations. There was variability of maturity in the populations collected. Population size varied from a few scattered plants to several hundred.

Over 25 known locations of the two species, *H. deserticola* and *H. anomalous*, were visited. For whatever reason, only three populations had plants with seeds for making a collection this year. There was a conspicuous absence of the two species in most of the areas explored. It has been 20 years since the last visit to these areas, but the absence of any plants in many of these areas indicates that it was not a good year for these species. It has been extremely dry in most of the area explored, with most of the locations having no evidence of these wild sunflowers this season. This led us to the conclusion that it was not an opportune year for the two species. Both species grow in very specific habitats which are very fragile, i.e. shifting sand dunes and sandy desert shrub habitats. Timing of the exploration may have been another factor. The present exploration was carried out two weeks earlier than the last exploration with the anticipation that there would be more mature heads with seeds, but some flowers would still be present to aid in identification of the species. This year it did not appear to make a difference, since no plants or evidence of plants were found in most sites visited.

The geographic area covered by the exploration was Utah, Arizona, and Nevada. The vegetation of this area is basically desert shrub. The area is mostly used as pasture land, with much of the area maintained and managed by the federal government. The geographic range covered coincides with the general species distributional range. The two populations of *H. anomalous* collected were typical populations being found in drifting sand of dunes. The populations were scattered over a long distance with large branching plants. Seldom do you see dense populations of this species. Morphologically, plants of these populations were typical of this species. Plants were just past peak flowering. Seed set appeared good. Powdery mildew was present on leaves of several plants. Some plants were partially buried in the drifting sand. The plants had very thick white tap roots, characteristic of this species.

The lone population of *H. deserticola* was collected in its typical habitat, sandy desert shrub vegetation. This was a typical population scattered throughout the shrubs over a very large area. Plants were morphologically typical for the species with very small cylindrical heads with small seeds. The seed set appeared to be good. Plants were just past peak flowering.

All species in the taxa to be collected list were collected. The disappointment was the sparse number of populations that were present this year. Many things enter into whether one finds a species or not, such as local environment, which was extremely dry this season, and recent

disturbances. Probably one of the most important factors is the time of year that one collects. In 2000, I am not sure it would have made a difference. It is difficult to believe that so many populations would have been lost over 20 years. We visited numerous suitable habitats for the species, but didn't find plants where they were previously recorded.

Insect damage was not apparent on the populations collected. This may have more to do with the time of flowering. When the seed in the heads is cleaned, insect damage will be more apparent.

The seeds of this exploration have been deposited at the NPGS Regional Plant Introduction Station at Ames, Iowa where they will be incorporated into the sunflower germplasm collection and assigned PI numbers. They will be maintained and distributed from that location.

Dr. Robert Webster, USDA-ARS Beltsville, MD has developed an assessment of the distribution of germplasm diversity in *Helianthus* based on sets of eco-geographic characters. It was the intent during the present exploration to evaluate the distributional maps generated by this project for the two taxa to be collected. Unfortunately, it was impossible to test the distributional maps due to the lack of populations of the two species during the present season. This will be evaluated in future explorations.

A number of fellow researchers supplied general and specific information about the distribution of the two species of wild sunflowers in the southwest. Their assistance is greatly appreciated. They are listed below:

Drs. Loren Rieseberg  
& and Charlie Heiser  
Department of Biology  
The Indiana University  
Bloomington, IN 47405

Dr. Stanley L. Welsh  
Monte L. Bean Herbarium  
Brigham Young University  
Provo, UT 84602

Dr. Mary E. Barkworth  
Curator, Intermountain Herbarium  
Utah State University  
Logan, UT 84322

# TAXA SUMMARY

<u>Species</u>	<u>Number of</u> <u>Accessions</u>
<u>Annual</u>	
<i>H. anomalous</i>	2
<i>H. deserticola</i>	1
	<hr/>
Total	3

## Itinerary for Utah, Arizona, and Nevada, US

September 16 - September 23, 2000

September 16, 2000 - Travel Fargo, ND to Price, UT.

September 17, 2000 - Travel Price, UT to Blanding, UT.

September 18, 2000 - Travel Blanding, UT to Page, AZ.

September 19, 2000 - Travel Page, AZ to Flagstaff, AZ.

September 20, 2000 - Travel Flagstaff, AZ to Boulder City, NV.

September 21, 2000 - Travel Boulder City, NV to Cedar City, UT.

September 22, 2000 - Travel Cedar City, UT to Salt Lake City, UT.

September 23, 2000 - Travel Salt Lake City, UT to Fargo, ND.

Collection Number	Species	Date Collected	Collected By	Collection Location	Annual (A) or Perennial (P)	Wild (W) or Cultivated (C)
2345	<i>H. deserticola</i>	9-21-00	GS=Gerald Seiler MB=Mary Brothers	USA, Utah, Washington County - 3.2 km southwest of Anderson Junction, Hwy 212 N, sandy roadside ditch between Interstate Hwy and state highway, 37°15'16" N. Lat. - 113°20'34" W. Long. 1072 M. Alt.	A	W
2346	<i>H. anomalous</i>	9-22-00	GS, MB	USA, Utah, Jaub County - 7.2 km west of Jericho Junction, off Hwy 6, Little Sahara Recreation Area, White Sands campsite and picnic area, loops A and B, edge of drifting sand dunes, 39°44'39" N. Lat. - 112°18'56" W. Long. 999 M. Alt.	A	W
2347	<i>H. anomalous</i>	9-22-00	GS, MB	USA, Utah, Jaub county - 7.2 km west of Jericho Junction, off Hwy 6, Little Sahara Recreation Area, Jericho picnic area, edge of shifting sand dunes, 39°41'14" N. Lat. - 112°22'06" W. Long. 1003 M. Alt.	A	W



Cedar City	306	329	289	281	236	205	111	54	247	353	364
Logan	329	102	321	46	207	129	239	383	79	253	191
Ogden	281	73	46	270	156	78	186	335	34	207	146
Provo	205	101	129	192	78	78	112	259	45	156	156
Salt Lake City	247	78	79	239	34	123	45	153	301	171	117

Mileage in red between red arrowheads, in black between intersections. Some interchange numbers indicate mileage.

Canyonlands National Park, J-10  
Capitol Reef National Park, J-8  
Cedar Breaks National Monument, L-4  
Dinosaur National Monument, E-11  
Golden Spike National Historic Site, B-5  
Zion National Park, M-4



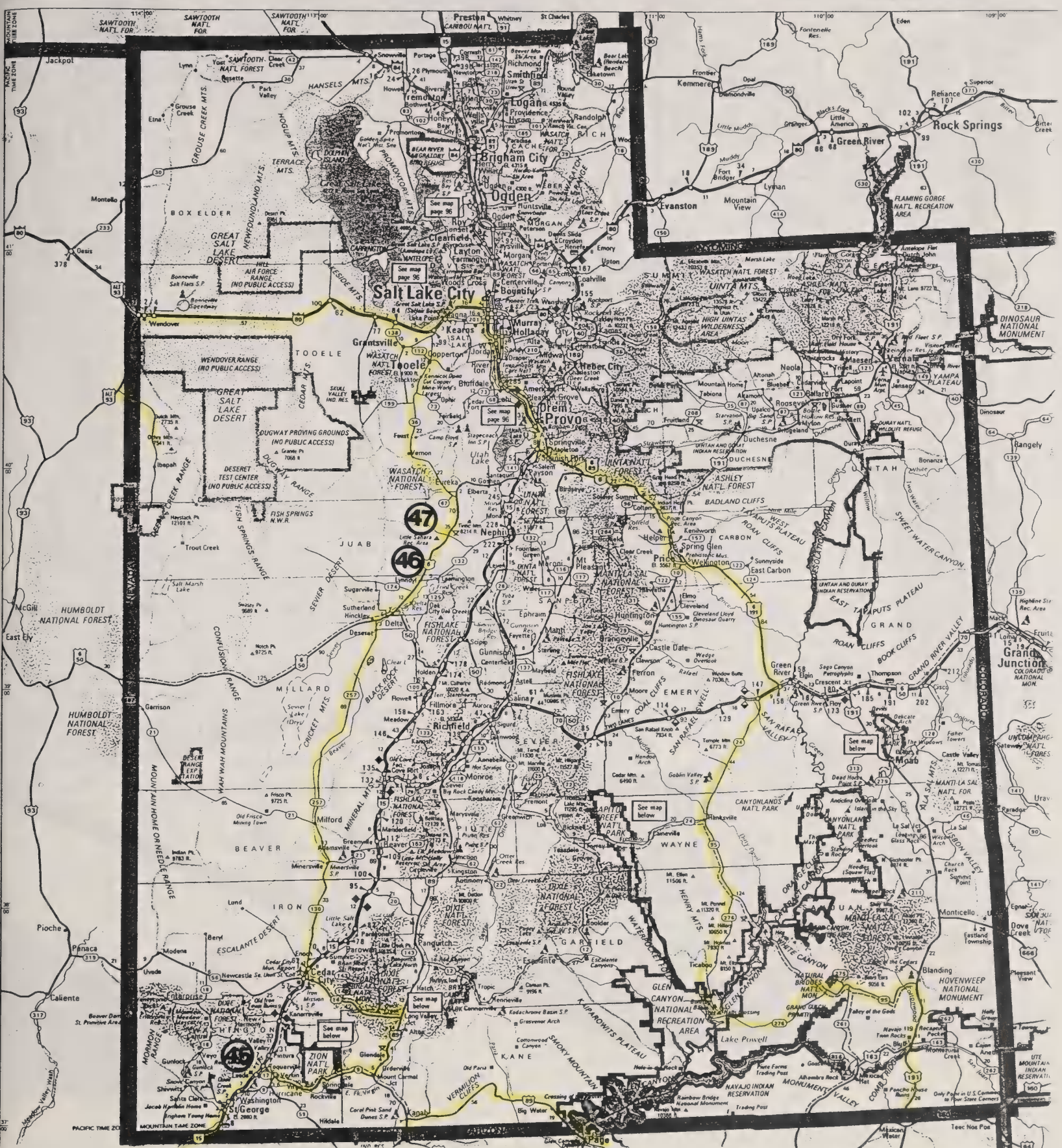
NV p.60



CO p.17  
AZ p.8  
NM p.70

Land Area: 82,076 sq. mi. (112)  
Population: 1,704,200 (35)  
Dimensions: N-S 345 miles, E-W 275 miles  
Highest Point: Kings Peak 13,528 ft., D-9  
Capital: Salt Lake City, D-6+  
Largest City: Salt Lake City, D-6  
Index page 126

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UTAH

MAP

1





# ARIZONA





NEVADA

MAP

3



### Plant Exploration: (Tom Gulya)

#### California- 2000

In September, 2000 I hosted Dr. Gary Kong, Toowoomba, Queensland, Australia to assist him in collected seed of wild *Helianthus annuus* in his attempt to find new sources of rust resistance. The collecting trip was made between 11 to 20 September, and covered 2800 miles from El Centro, CA (next to the Mexican border) and Ft. Bragg (on the Pacific coast, 200 miles south of the Oregon border). Sixty collections were made, of which 56 were *H. annuus*, two were *H. bollanderii* (or *exilis*), one *H. gracilentus* and one *H. californicus*. One-half of the seed collected was retained at Fargo, where it is being shared with Gerald Seiler. Dr. Kong has screened the *H. annuus* collections in quarantine greenhouses in Australia, and I am tested the rust resistant accessions for downy mildew resistance in an attempt to combine resistance to both diseases.

One side aspect of this trip was the discovery that the Ames collection has *H. bollanderii* and *H. exilis* lumped as one species, as per the taxonomy of Heiser. It would be useful, however, to make some additional collections in California at sites known to have "serpentine" soils in an attempt to collect bona fide samples of the "serpentine sunflower," *H. exilis*. None of the 17 accessions of *H. bolanderii/exilis* is currently in the "available" category, so collections of large seed amounts would be warranted. Geological maps of CA are available from the CA Dept. of Mines which pinpoint the location of serpentine soils. Additionally, a plant ecologist at UC Davis (Dr. Susan Harrison) currently has several graduate students doing research on *H. exilis*, so it would be opportune to contact this individual to assist in seed collections. Contacts include:

Dr. Susan Harrison, Dept. Plant Ecology	<a href="mailto:spharrison@ucdavis.edu">spharrison@ucdavis.edu</a>
Amy Freestone (graduate student)	<a href="mailto:alfreestone@ucdavis.edu">alfreestone@ucdavis.edu</a>
Juliano Montero Sambatti (grad student)	<a href="mailto:jbsambatt@ucdavis.edu">jbsambatt@ucdavis.edu</a>



**Plant Exploration:** (Tom Gulya)**California 2001**

While visiting southern CA in February and March, 2001 to conduct field experiments at the U. CA El Centro Desert Research Farm, I made several collecting trips to the Algodones Dunes area and other active dune sites in southern CA and southwestern AZ. The main objective was to find sites and if possible, seed of *Helianthus niveus ssp. tephrodes*. I made many email and first hand contacts with botanists and biologists with universities and other state and federal agencies. Seed of *H. niveus ssp. tephrodes* was collected during March from the Algodones Dunes, but I was unsuccessful in finding plants in any other dune site. Sites visited included the Yuma dunes (south of Yuma on Marine Air Corps target sites, and visitable only with permits and accompaniment of Marine personnel), Mohawk dunes, Pinta Sands (on Cabeza Prieta NWR), and Cactus dunes. I also was given copies of several flora commissioned by the NWR or the Marine base which list plant species found during the past decade. None of these flora cited the observation of *H. niveus ssp. tephrodes* anywhere, with the exception of the Algodones dunes. The California Bureau of Land Management completed a study of "special status plants" which includes *H. niveus ssp. tephrodes*. In this study, published in November, 2000, they compared the distribution and density of "*tephrodes*" in 1998 versus a first study in 1977 to assess the long-term survival all "special status plants" in both restricted-use areas and those areas open to recreational (dune buggy) vehicles. Contact persons for future explorations in this general area include:

Deborah Sebesta, US Dept. Interior, BLM, El Centro Field Office CA  
760-337-4429 [dsebesta@ca.blm.gov](mailto:dsebesta@ca.blm.gov)

John Morart, US Fish & Wildlife Service, Cabeza Prieta Nat. Wildlife Refuge AZ  
520-387-6483 [John\\_morart@fws.gov](mailto:John_morart@fws.gov)

Michael Coffeen US Fish & Wildlife Service, Phoenix, AZ  
602-242-0210 [mike\\_coffeen@fws.gov](mailto:mike_coffeen@fws.gov)

Dr. Wylie Homesley, Range Mngt. Office, Marine Corps Air Station, Yuma AZ  
520-341-3656 [homesleywb@ex.yuma.usmc.mil](mailto:homesleywb@ex.yuma.usmc.mil)

After several futile explorations and reading various floras, it is my conclusion that the distribution of *H. niveus ssp. tephrodes* in the United States is limited to the Algodones Dunes of California, and possibly the Pinta Sands area (on the Mexican border) in the Cabeza Prieta NWR of AZ. There is a herbarium record of *tephrodes* from the Pinta Sands, but no authenticated plants were found in 2001. The distribution of *H. niveus ssp. tephrodes* is undoubtedly concentrated with the Gran Desierto (a subsection of the Sonoran desert) immediately south of the Arizona border in the Mexican state of Sonora. A potential Mexican contact for future exploations in this area is:

Dr. Eric Mellink  
CICESE, Apdo Postal 2732  
Ensenada, B.C. Mexico

(US mailing address: PO Box 434844  
San Diego, CA 92143)  
[emillink@cicese.mx](mailto:emillink@cicese.mx)

**Useful reference:**

Willoughby, John. 2000. Monitoring of Special Status Plants in the Algodones Dunes, Imperial County, California. 39 pages, plus 24 pages of unnumbered colored maps.



## APPENDIX 9

8-2001

### BY-LAWS FOR THE SUNFLOWER CROP GERMPLASM COMMITTEE

#### NAME:

The official name for the committee concerning all species of *Helianthus* shall be the "Sunflower Crop Germplasm Committee".

#### FUNCTION:

To gather a committee of scientists and advisors on wild and cultivated *Helianthus* species to provide expert advice on germplasm collection, maintenance, evaluation, and enhancement for the curator of the sunflower collection, scientists of industry and public research programs, and organizations such as the USDA, Agricultural Research Service (ARS) and State Agricultural Experiment Stations (SAES).

#### OBJECTIVES:

1. Provide a strategic plan for strengthening the national scientific efforts on sunflower germplasm. Recommend means for organizing activities that would benefit the national program on the acquisition, maintenance, evaluation, and enhancement of sunflower germplasm.
2. Assess the adequacy of sunflower germplasm available to the scientific community and make recommendations to the National Plant Germplasm System for broadening the present germplasm base by additional acquisition through exploration and exchange.
3. Help develop guidelines for the effective maintenance of sunflower introductions.
4. Develop a strategic plan for evaluation of the sunflower germplasm collection for priority descriptors and to update the descriptor list as changes occur.
5. Consider needs for increasing the genetic variability of sunflower germplasm and develop a viable enhancement plan.
6. Provide a means for industry researchers to express needs for sunflower germplasm resources and their utilization.
7. Develop reports for National Plant Germplasm System and the ARS National Program Leaders for germplasm and oilseeds of ongoing germplasm activities, resource needs and status of evaluation, enhancement, and exploration plans.



8. Encourage greater cooperation among industry, federal, state, and other scientists for exchange of germplasm and descriptor information and for dissemination of information from scientists to commodity groups.

9. Maintain an awareness of sunflower germplasm activity of other national and international programs and cooperate in exchange of information and germplasm.

#### **MEMBERSHIP:**

1. Researchers from USDA. Three representatives.

2. Researchers from State Agricultural Experiment Stations. Three representatives.

3. Researchers from the sunflower industry. Three representatives.

4. Coordinator of the North Central Plant Introduction Station, or his or her representative, shall be a permanent member of the Committee, serving in an ex-officio capacity.

5. The representatives from the National Program Staff for Germplasm and Oilseeds, shall be ex-officio members of this committee. Representatives from the National Plant Germplasm Resources Laboratory, the Plant Introduction Stations, the National Sunflower Association, and others may serve as consultants and ex-officio members for resource purposes.

Members of the Sunflower Crop Germplasm Committee shall serve four-year terms. The Chair will be elected for a four-year term. The Vice-Chair's term will coincide with the term of the affiliated person elected to that position. The Chair position will be a non-affiliated position, and their affiliation will not alter the balance of the Committee. All people having served previously on the Committee will be eligible for the Chair position.

New members of the Sunflower Crop Germplasm Committee will be recommended by the Sunflower CGC and approved by the Executive Committee of the National Sunflower Association. Any vacancy on the Committee will be appointed by the Chair, with the approval of the Committee.

#### **FACILITATION:**

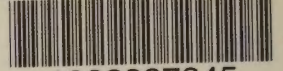
1. The Sunflower Crop Germplasm Committee will be facilitated through the office of the Coordinator, National Plant Germplasm Resources Laboratory (NPGRL), USDA-ARS, Beltsville, MD.

2. The Sunflower Crop Germplasm Committee will report their activities to the Germplasm Program Coordinator, the National Program Leaders, and the sponsoring association, the National Sunflower Association.





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